BIOABSORBABLE TISSUE TACK WITH OVAL-SHAPED HEAD AND METHOD OF TISSUE FIXATION USING THE SAME

This application is a continuation-in-part of U.S. Application Serial No. 10/083,568, filed February 27, 2002, which is a continuation-in-part of U.S. Application Serial No. 09/495,816, filed February 2, 2000, now U.S. Pat. 6,517,564, which claims the benefit of U.S. Provisional Application Serial No. 60/118,228, filed February 2, 1999 and U.S. Provisional Application Serial No. 60/125,781, filed March 23, 1999, the entire disclosures of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to sutureless fixation of tissue to bone. More specifically, the present invention relates to a bioabsorbable cannulated tissue tack with an angled or straight oval-shaped head for sutureless tissue fixation in the shoulder.

2. Description of the Related Art:

When soft tissue tears away from bone, reattachment becomes necessary. Various fixation devices, including sutures, screws, staples, wedges, and plugs have been used in the past to secure soft tissue to bone. More recently, various types of threaded suture anchors have been developed.

The known suture anchors generally require that the surgeon tie knots in the suture to secure tissue to the bone. Tying surgical knots is tedious and time-

consuming. It would be preferable to be able to secure the soft tissue to the bone in one step without having to tie knots.

Accordingly, a need exists for a bioabsorbable anchor for soft tissue fixation that can be installed to secure tissue easily and effectively without sutures. A need also exists for a soft tissue fixation device having a low profile configuration particularly suited for reattachment of tissue to the glenoid rim.

SUMMARY OF THE INVENTION

The present invention overcomes disadvantages of the prior art and fulfills the needs discussed above by providing a bioabsorbable tissue tack for sutureless fixation of soft tissue to bone. The tissue tack is cannulated and has a tack-shaped configuration. The head of the tack is oblong to provide a low-profile, and is mounted on a cannulated shaft. The head is mounted at a perpendicular angle to the shaft, or, alternatively, at an anatomic angle.

Preferred indications for the tissue tack of the present invention include arthroscopic or open repair of glenohumeral joint pathologies. These include reattachment of the glenoid labrum or inferior glenohumeral ligament in patients with primary or recurrent anterior dislocation or subluxation of the shoulder, in association with adequate post-operative immobilization.

The oblong shape of the tack head provides a narrow profile in one direction to allow head alignment along the glenoid rim. In a preferred embodiment, the heads are oval or elliptical in shape, although a rectangular or diamond oblong shape, for example, also could be used. The oblong head of the installed tack is aligned with the glenoid rim in shoulder repairs, for example, to present a low profile that prevents contact of the tack with articular surfaces.

Advantageously, according to an alternative embodiment, the oblong head is disposed on the shaft in an angled configuration for situations in which the insertion portal of the tack is not perpendicular to the glenoid rim. Accordingly, both of the extended sides of the oblong head will sit flush with the tissue along the glenoid rim.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective scale view of a bioabsorbable tissue tack with a straight head according to the present invention.

Fig. 2 is a perspective scale view of a bioabsorbable tissue tack with a straight head according to an alternative embodiment of the present invention.

Fig. 3 is a plan scale view of a bioabsorbable tissue tack with an angled head according to the present invention.

Figs. 4-6 are schematic views illustrating a preferred method of shoulder repair according to the present invention.

Fig. 7 is a plan view of a tissue tack driver according to the present invention.

Fig. 8 is an end view detailing the head of the tissue tack driver of Fig. 7.

Fig. 9 is a cross-sectional plan view of a centering sleeve according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A straight-headed bioabsorbable tissue tack **2** according to the present invention is shown in Figs. 1-2. A tissue tack **22** having an angled head according to the present is shown in Fig. 3.

Referring to Figs. 1-2, tissue tack **2** includes a cannulated shaft **4** with an oval-shaped cannulated head **6** disposed on the proximal end of the shaft. Tissue tack **2** has a blunt (i.e., flat) tip **5**. In the embodiment of the invention shown in Figs. 1-2, the head **6** is formed at a perpendicular angle with respect to the shaft **4**. Anchoring barbs **7** are disposed on the longitudinal ends of oval-shaped head **6** and have pointed tips which extend distally toward the tip **5** of tack **2** to engage the labrum upon insertion. A cannula **8** extends continuously through the entire length of the tack **2**, i.e., through both the head **6** and the tip **5** as well as the shaft **4**. The cannula is 2.4 mm in diameter.

Tack **2** is provided with slotted ribs **10** formed circumferentially at least partially around and partially along the length of shaft **4**. Ribs **10** have a truncated, conical shape, increasing in diameter toward the head of the tack at an angle of preferably 15° with respect to the longitudinal axis of tack **2**, and reaching a major diameter of 3.0 mm. Slots **12** are formed in ribs **10** on alternating sides of shaft **4**. The slots provide access for ingrowth of bony tissue for enhanced pullout strength.

Fig. 3 shows an embodiment in which a tissue tack **22** of the present invention is provided with an angled head. Specifically, tissue tack **22** has a cannulated shaft **24** provided with a cannulated oval-shaped head **26** disposed at an angle of 30° from the perpendicular with respect to the shaft **24**. The 30° angle allows flush seating of the tack in the three o'clock to five o'clock positions, or the

posterior superior labral positions, of the glenoid rim. As in the embodiment of Figs. 1-2, a cannula **28** extends through the entire length of the tack **22**, and tack **22** is provided with ribs **30** having slots **32** disposed on alternating sides of shaft **24**.

The head is provided in 3.0 mm and 4.5 mm sizes (widths) to accommodate different anatomies. The 4.5 mm. tissue tack is preferably provided with four barbs (two at each end of the oval), whereas the 3.0 mm. tissue tack has only two barbs (one at each end). In both cases, the major (end-to-end) length of the head is 7.0 mm, and the head is 1.65 mm thick. The working length of the implant, from the underside of the head to the distal tip, is 12.34 mm for the 3.0 mm head, and 14.7 mm for the 4.5 mm head. There is a smooth area of 3.07 mm from the most proximal edge of the most proximal rib to the underside of the head in both cases.

The preferred material for the tack is a non-crystalline, amorphous poly (L-lactide-co-D,L-lactide) 70%:30% (PLDLA) copolymer. This material reduces tissue reaction. The tack becomes encapsulated by fibrous tissue within six weeks after implantation, and generally degrades within 12 to 16 months. Although PLDLA is the most preferred material, other bioabsorbable materials known in the art can be utilized. As used herein, bioabsorbable is considered to be interchangeable with biodegradable, resorbable and absorbable to mean that the device can be absorbed by the body over time.

The tissue tack of the present invention is particularly well suited for reattachment of the glenoid labrum or inferior glenohumeral ligament in patients with primary or recurrent anterior dislocation or subluxation of the shoulder in association with adequate post-operative immobilization.

A preferred method of installing the tack is described in connection with performing an arthroscopic Bankart repair will now be described with reference to Figs. 4-9.

Referring initially to Fig. 4, the arthroscopic procedure is performed within the shoulder through an access cannula **38**. A 2.4 mm cannulated spear **40**, such as that disclosed in pending U.S. Patent No. 5,951,559, the disclosure of which is incorporated herein by reference, is inserted through the glenoid labrum **42** using an obturator (not shown). Laser markings **44** on the spear are referenced to confirm a perpendicular pilot hole for the straight or angled tissue tack. The labrum is shifted to the glenoid rim **46** using the spear.

The obturator is removed, leaving the spear in place holding the labrum proximate the glenoid rim. A non-cannulated 2.4 mm drill (not shown) is inserted into the spear. A window **48** in the spear provides arthroscopic control and visualization of the drill. A pilot hole **50** is drilled to a depth of 13 mm using a laser line (not shown) located distally on the drill as a depth stop reference.

The drill is removed, and a cannulated centering sleeve **52** (see also Fig. 9) is inserted into the spear (1 mm ID). The centering sleeve is pushed or tapped into the pilot hole **50**. This allows central placement of a nitinol guide wire **54** into the pilot hole.

The 1 mm guide wire **54** is drilled or pushed, preferably using an insertion cap (not shown) such that the guide wire advances past the end of the centering sleeve up to a laser line on the guide wire. This locates the guide wire 5 mm further into cancellous bone to prevent the wire from coming out.

Once the guide wire **54** is secured in the base of the pilot hole **50**, the centering sleeve **52** and the spear **40** are removed, leaving the guide wire **54** in position.

Referring to Fig. 5, a tissue tack **22** according to the present invention is installed over the guide wire **54**. A cannulated tissue tack driver **56**, having a 30° angled head as shown in Fig. 5, and described more fully below, is placed over the guide wire and engages the tack **22**. Using the driver, the tack is advanced along the guide wire and into the pilot hole **50**. Rotational adjustments can be made while the implant is partially seated, before barbs **27** tack into the labrum **42**.

Referring to Fig. 6, further tissue tacks can be inserted in a similar manner to further secure the labrum. Accordingly, straight headed tack **2** is inserted into a second pilot hole **60** using a straight-headed driver **70** as shown in Figs. 7 and 8. Driver **70** is similar to angle-headed driver **56** described above. The tissue driver has a cannulated handle **72** disposed on a cannulated shaft **74**. The drive head **76** has a recessed portion **78** having a size and shape that corresponds to the head of the associated tissue tack. The recess **78** is flanked by two curved walls **80** separated by slots **82** engage either side of the tissue tack head and allow for proper alignment of the tissue tack with the glenoid rim during insertion, as noted above.

Once the tack has been properly aligned, a tamp **84** is driven with a mallet (not shown) to fully seat the tack with the long axis of the oblong head of the tissue tack aligned along the rim of the glenoid. The head of the tack is brought into flush proximity with the tissue surface, the tack slightly compressing the labrum. Tack **22** is shown having been seated using a tamp with an angled offset head. Placement of each tack is finalized by remove the guide wire and the driver.

Advantageously, the method and instrumentation of the present invention provide for placement of the guide wire after formation of the drill hole. This eliminates the possibility that the guide wire is inadvertently removed. In addition, the tack driver fully encloses the guide wire during insertion, thus eliminating the chance of surgical glove penetration. Repair of SLAP (superior labrum anterior posterior) lesions can be effected in a similar manner.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art.